Mine Safety – Checklist

PREAMBLE

Mine safety is a broad term referring to the practice of controlling and managing a wide range of hazards associated with the life cycle of mining-related activities. Mine safety practice involves the implementation of recognised hazard controls and/or reduction of risks associated with mining activities to legally, socially and morally acceptable levels. While the fundamental principle of mine safety is to remove health and safety risks to mine workers, mining safety practice may also focus on the reduction of risks to plant (machinery) together with the structure and orebody of the mine.
Safety has long been a concern in the mining business, especially in underground mining. The Courrières mine disaster, Europe's worst mining accident, involved the death of 1,099 miners in Northern France on March 10, 1906. This disaster was surpassed only by the Benxihu Colliery accident in China on April 26, 1942, which killed 1,549 miners.[3] While mining today is substantially safer than it was in previous decades, mining accidents still occur. Government figures from China indicate that 5,000 Chinese miners die in accidents each year, while other reports have suggested a figure as high as 20,000. Mining accidents continue worldwide, including accidents causing dozens of fatalities at a time such as the 2007 Ulyanovskaya Mine disaster in Russia, the 2009 Heilongjiang mine explosion in China, and the 2010 Upper Big Branch Mine disaster in the United States.

PREVENTION

Here are seven ways **Mine Operators** can make their facilities safer and more efficient.

1) Invest in wireless underground communications

Swap your hard-wired pagers for a mobile leaky-feeder

communications system. This is a handheld radio which every worker who has one to communicate with colleagues underground and also allows miners (and equipment) to be quickly located. Effective communications and tracking technology is essential in case of an accident underground.

2) Automation can improve safety underground

Carroll Technologies Group CEO Tom Bannister said: "If you take human error out of it you can have a lot safer working environment, in most cases. I do [see automation becoming more prominent] and there are a lot of devices in mining that are that way. We're doing a lot of things with remote, wireless remote controls now, so the individual doesn't have to be on that piece of machinery to run it – he stays out of harm's way and doesn't have to get under unsupported top, or stay out of hazardous areas and check equipment remotely."

3) Using data to improve mine safety

Atmospheric monitoring information collected through leaky-feeder devices can be used to provide mine managers with vital safety data.

Carroll Engineering president Allen Haywood said: "One of the things they use that data for, that they want to look at and serve operations, is air flow.

"It's critical for these operations to have proper ventilation to keep air flowing throughout the mines underground, and they can measure, on this system, the amount of air flow in particular areas.

"And that's recorded, in case they want to go back and look and see what that air flow is, they can go back and look at the history of that."

4) How drones can improve mine safety

Joe Carr, of Inmarsat, told Mining Technology: "Freeport-McMoRan is already using drones to create steeper pit slope angles

in its mines, reducing the stripping ratio and amount of waste rock hauled before ore can be extracted. These drones not only scan the mines from perspectives that are dangerous and near-inaccessible to humans, they also instantaneously communicate any information they pick up. This makes for a more rapid and detailed analysis of the mine slopes without having to deploy highly skilled geologists or geotechnical engineers into an inherently hazardous environment or affecting production by closing haul roads.

"With machines becoming progressively more capable of acting with little manual intervention, a future where adaptable and autonomous machines carry out the on-site, operational tasks of mining while human employees monitor them remotely looks probable and highly profitable."

5) Kit miners out with self-contained rescuers

Self-contained rescuers are a portable device which provides a supply of breathable oxygen to miners should they become trapped underground, or should poisonous gases leak into mineshafts.

The standard SCSR features an oxygen scrubber, which can chemically remove impurities from the atmosphere to provide a miner with breathable oxygen.

Many of the most significant mining accidents occur due to a lack of oxygen or the presence of poisonous gases.

6) Consider switching from wire to synthetic rope

According to Donna Poll of Samson rope: "When wire rope breaks there's a danger of damaging the surrounding area and people. Synthetic rope has much more predictable recoil properties."

She said that because synthetic rope is much lighter than wire there is also less likelihood of strain and sprain injuries when handling it.

7) Put systems in place to avoid collisions underground

Collisions involving heavy vehicles are one of the major causes of

injuries underground.

One way to reduce the risks is to install proximity detection devices which sound an alarm when a large piece of equipment is getting close to another one.

The introduction of strict safety legislation, as well as advances in safety equipment, the industry has seen its fatality rate drop over time.

The following steps will advance the safety of miners

1. Coal dust

- Dust inhalation or coal dust is one of the most common concerns for miners.
- The ongoing inhalation of coal dust can cause what is known as ‘miner’s lung’ or ‘black lung’. Miner’s lung is a form of the occupational lung disease group pneumoconiosis. Symptoms include shortness of breath and scarring of lung tissue, which causes ongoing respiratory issues.
- Black lung has been legally enforced for many years now but new cases still occur among coal miners.
- Mining companies need to develop a dust control plan, and supervisors must ensure that dust control systems are working properly for every production shift.
- Mine workers must be trained on the hazards of over-exposure to coal mine dust.
- Respiratory protection should be used when dust control protection is being installed, maintained or repaired.

Noise

- The potential for hearing damage is serious with the constant drilling and heavy machinery.
- Many people don’t notice the damage to their hearing until long after they were first exposed to the noisy environment, as most damage occurs very slowly.
- "Over-exposure to excessive noise can result in tinnitus (ringing in the ears), sleep disturbances, concentration problems and even permanent hearing loss.

- Mining companies need to evaluate working conditions and noise exposure through risk assessments.
- Avoiding and reducing exposure can be achieved by applying engineering controls at the noise source or along the noise path to reduce exposures.
- Regular maintenance of machines is essential to reducing noise.
- Employer must ensure proper use of personal hearing protection amongst noise-exposed employees.
- Provide necessary health and safety training and maintain up-to-date health surveillance records.

Whole body vibration

- Whole body vibration (WBV) is a slow forming physical hazard that occurs to mining workers.
- WBV can be caused either by spending a lot of time sitting on machinery, which is most of the time in mining extraction, or by standing, such as working on jumbo operators.
- Some forms of vibration are ok, but become dangerous when they involve uneven surfaces, vehicle activity such as ripping versus pushing material in a bulldozer, and engine vibrations.
- Symptoms of WBV include musculoskeletal disorders, reproductive damage in females, vision impairment, digestive problems and cardiovascular changes.
- Reducing exposure does reduce health risks and the first step that mining should companies take. This includes filling in potholes on unmade roads, minimizing the transport of goods or materials, or replacing manned with unmanned machines such as remotely controlled conveyors.
- Where risks cannot be avoided, supervisors need to reduce the time employees use the machine each day.
- Instruction and training are critical.
- Symptoms of back pain in employees must be closely monitored.

UV Exposure

- There is risk of over-exposure to UV (ultraviolet) radiation in sunlight for pit-miners.
- Over exposure of ultraviolet rays can put you at risk of skin cancer. UV rays cause melanomas to form, but they can cause serious damage to your eyes if you are not wearing protective eye wear.
- Overexposure to the sun can cause dehydration, headaches and nausea.
- Mine workers often spend whole days out in the baking hot sun, and are at a very high risk of developing cancer and eye problems.
- Employers should conduct a risk assessment on outdoor work scheduled to assist in developing appropriate sun protection measures.
- The effective way to reducing UV exposure is to use a combination of re-organizing work to avoid the UV peak of the day.
- Provide natural or artificial shade.
- Provide appropriate protective clothing, and applying sunscreen.
- Employers must train employees to raise awareness of the risks associated with exposure to UV and the sun protection measures required.
- Employers can provide skin cancer checks as part of regular workplace medical examinations and in pre-employment medical checks.

Musculoskeletal disorders

- Musculoskeletal disorders (MSDs) refer to any problems affecting your bones, muscles, blood vessels and nerves.
- Musculoskeletal damage can occur due to a trip, fall or heavy lift, the more serious ones occur slowly over time due to ongoing heavy lifting or repetitive strains.
- Employers should identify and assess job-related MSDs hazards and put in place controls to reduce workers' exposure to MSDs hazards.
- Workers need be advised and trained about MSDs hazards in their job and workplace and encouraged to participate in

health and safety programs.
- Employers need to follow up to ensure preventative measures are working.

Thermal stress

- A common health risk that miners face is thermal – or heat – stress.
- Overexposure to heat and humidity causes the body to become fatigued and distressed which results in heat stroke or more serious ongoing health problems.
- Where there is a possibility of heat stress occurring, companies must carry out a risk assessment that considers the work rate, working climate, worker clothing and respiratory protective equipment.
- Control the temperature using engineering solutions, provide mechanical aids where possible to reduce the work rate, and regulate the length of exposure to hot environments.
- Personal protective equipment must be provided, such as specialized protective clothing that incorporates personal cooling systems or breathable fabrics.
- Companies must provide training for workers, especially new and young employees, and monitor the health of workers at risk.

Chemical hazards

- Mine workers are often exposed to harmful chemicals.
- The most common group of chemicals that cause concern in a coal mining environment are polymeric chemicals.
- Regardless of the chemicals you work in close proximity, appropriate safety wear and precautions need to be taken to minimize your body’s exposure to them. Risks include chemical burns, respiratory problems and poisoning.
- Each chemical has a unique set of hazards and needs to be handled properly to ensure worker safety and employers according need to conduct risk assessments to establish best practices.
- A standard operating procedure (SOP) that addresses the use of correct personal protective equipment, safe handling,

safe use, and proper disposal must be established.
- Thorough training and drills should be conducted regarding the company's spill response plans and chemical hygiene plans.
- Ventilation, general housekeeping and cleanliness are important factor to minimize exposure.

7 Steps to Safer, Healthier Mining Employees

Taking these seven steps can make your job easier and your workplace safer.

1. Ensure compliance with safety and health standards. Make sure you're complying in every detail with every standard that applies to your operations and your workplace. Also check state regulations, which if they're stricter than federal standards, take precedence. And don't forget about your own safety policies. Ensure compliance with those rules, too.

2. Keep employees informed about hazards. Identify every hazard in every work area and in every job, and make sure employees who might be exposed to any hazards know:

- What the hazards are.
- How they are dangerous.
- How to protect against them.
- What to do in the event of exposure to a particular hazard.

3. Take appropriate steps to minimize risks. This involves many things including:

- Well-conceived and implemented workplace safety and health programs.
- Routine and thorough inspections and safety audits.
- Effective engineering, administrative, and work practice controls.
- Frequent and effective employee training.
- Appropriate PPE to protect employees from hazards when controls are not enough.
- Routine workplace maintenance.

4. Teach employees to work safely. Training is one of your most power accident-prevention tools. Teach the information, skills, techniques, and procedures employees need to know to be safe and healthy. Train frequently to keep workers up to date on workplace and regulatory changes and to keep them aware, alert, and prepared to work safely.

5. Monitor performance and provide feedback. Don't assume that workers will use what they learn in training or do what their supervisors tell them to do. For all kinds of reasons workers will decide to take risks or ignore warnings and instructions. Make sure your supervisors monitor safety performance and provide positive or corrective feedback to maintain safe and healthy behavior.

6. Pay attention to employees' suggestions and complaints. You may not be able to use all the suggestions or be thrilled about the complaints, but listening to employees is essential if you want to get them to be on board with your safety and health programs and to follow your safety rules. The big plus here is that employee participation leads to employee ownership, which leads to employee-driven safety and a safer workplace.

7. Move quickly to correct problems. Foot-dragging over hazard abatement sends a bad message to employees. It says you don't care about their safety. So, take swift and effective action whenever a safety or health problem is brought to your attention.